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The Population of New Hampshire

2. MIGRATION AND CHANGES IN COMPOSITION

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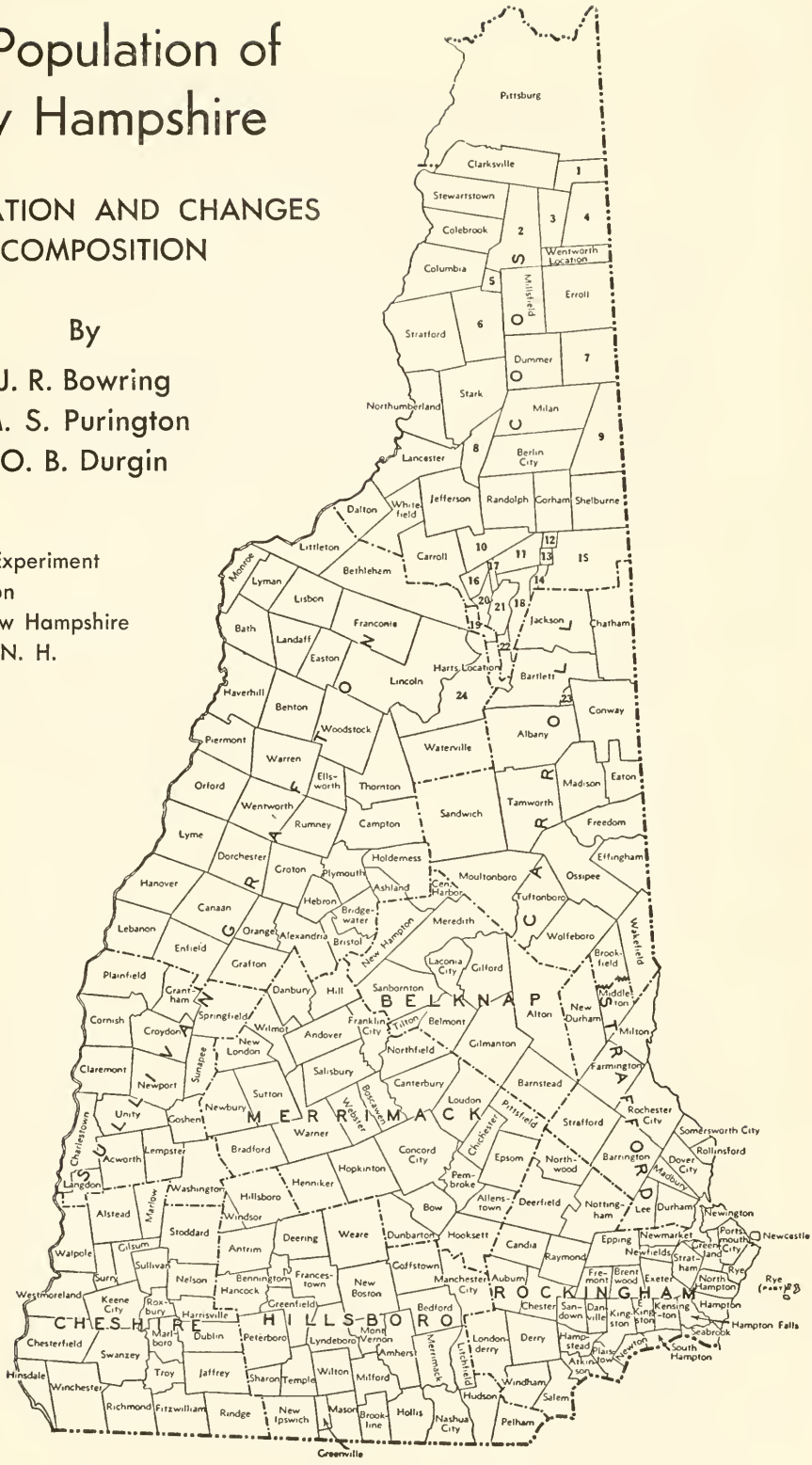

FOREWORD

This is the second in a series of bulletins dealing with the effects of changes in the number and location of people in New Hampshire. The first study in the series entitled *Trends and Characteristics*, Agricultural Experiment Station Bulletin 413, is available on request to Mail Service, University of New Hampshire, Durham, New Hampshire.

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By J. R. Bowring, M. C. Purington, O. B. Durgin*

THERE IS a continuous movement of residents into and out of New Hampshire as there is in other populated areas of the United States. The U. S. Bureau of Census estimates that a number of people, approximating 25 percent of the total population, move across state lines within a 10-year period. The size or rate of the movement depends among other factors, on economic incentives and alternative opportunities for improved standards of living. The number entering and leaving a state will very likely reflect the availability of such alternatives in that state.

Similarly there is a movement of people within the state across county lines. Nationally the number so moving in a 10-year period is equivalent to approximately two thirds of the total population for any one year. A movement of such magnitude is of economic and sociological interest because of its relation to resource utilization, taxation, the problems of representation, and the provision of public services.

This study is an attempt to measure migration to and from counties of the State of New Hampshire between 1940 and 1950. It will also approximate mobility of rural farm, rural nonfarm, and urban residents between these years.

Of particular significance is the measure of migration by sex and age which isolates those ages at which net in-migration and net out-migration are greatest. This measure provides an analytical technique which may prove of value to local government agencies and those concerned with vital statistics. In addition, the study includes measures of the importance of children up to 14 years of age and people over 65 relative to the working age groups in each county. This is known as the dependency ratio and points to the significance of the aged in the population structure. The number of children born in this decade has increased the fertility ratio for all counties and the significance of this measure is discussed.

Previous Work

Bulletin 413 of the New Hampshire Agricultural Experiment Station, the first in this series, provides summary data of the population distribution and trends in numbers up to 1950 by counties. These data are based on the U. S. Census and illustrate that population of the northern towns and counties has been decreasing and in the southern counties it has been increasing during the past few decades. Of some importance is the increase in the rural nonfarm population and the decline in rural farm residents. It shows the increase in birth rates, the education of residents, and the distribution of families by cash income. Brief mention is made of migration.

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Method of Analysis*

Population increase or decrease is the result of natural change (birth and death) plus change due to migration. To obtain an estimate of net migration during the period 1940-1950, the population to be expected in 1950 was computed for the counties of the state. Births and deaths for each year of the 10-year period were tabulated by county of residence. Deaths were subtracted from births, and the difference added to the 1950 population of these counties. The sum represented the expected 1950 population based on natural increase. The figure was then compared with the 1950 census count and the difference measured the extent of net migration and its direction. Because of the small size of the state and the relative degree of urbanization together with the apparent accuracy of the data, no correction was made for under-enumeration or under-registration of births.

One change in census definition relating to the residence of boarding students has some distorting influence on county data in New Hampshire. In the census of 1940 boarding students were allocated to the county of parental residence. In 1950 these students were counted as residents of the county in which the institution was located. Grafton and Strafford counties, where Dartmouth College and the University of New Hampshire are located, are affected most by this change in method. The more obvious distortion of data due to the change will be footnoted in the appropriate tables.

Two other changes in census procedure and definition in 1950 from those used in 1940 affected the procedure employed in this study. The 1950 definition of rural nonfarm excludes a number of persons who would have been so counted in 1940. The instructions to enumerators were such that the 1950 farm population is somewhat smaller than would have been the case had the 1940 instructions to enumerators been used. These residence categories are only roughly comparable between 1940 and 1950. However, data on rural-urban residence by age by county according to the 1940 definition are available in the 1950 census. The closed age groups extend only to those 64 in 1950 and so estimates of migration by these residence categories are limited to the age groups 0-54 in 1940 and 10-64 in 1950. This limitation has been adopted in order to provide the best estimate of net migration by age among census residence classes. Migration for the total population is measured for all age groups by county and for the state.

This study also assesses the influence of migration on the dependency, fertility, and sex ratios which are standard measures of population structure.

Net Migration by Counties

The net migration of male and female residents to and from the counties of New Hampshire between 1940 and 1950 is given in Table 1. Some counties showed a greater net loss or net gain than others. Estimates of migration for the state show a net in-migration of females and a net out-migration of males during this 10-year period resulting in a net increase in the state of 1,732. The inclusion of out-of-state students in the 1950 residence categories may well account for this increase so that the true net migration for the state is closer to zero.

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* See Appendix 1.

Table 1. Net Migration for New Hampshire by Counties — 1940 to 1950

County	Male	Female	Total
Belknap	—131	432	301
Carroll	—193	—151	—344
Cheshire	39	815	854
Coos	—3853	—2986	—6839
Grafton	413	—1345	—932
Hillsboro	—981	715	—266
Merrimack	—1173	389	—784
Rockingham	3148	3942	7090
Strafford	2153	2102	4255
Sullivan	—1114	—489	—1603
State	—1692	3424	1732

Within County Movement

There is undoubtedly much movement within counties but no attempt has been made to measure such movement in this study. The U. S. Census measures the annual mobility status in the Northeast Region as of April, 1955, at 13.9 percent of the total population. Of this number 9.6 percent moved in the same county, 2.8 percent between counties, and 1.6 percent between states.* The proportionate New Hampshire migration between counties is similar to the Northeast Region and it may be assumed that the proportion of within county movement is similar.

The Northeast Region is relatively stable compared with the other regions of the United States where 29.6 of the West Region residents lived in a different house from the previous year while only 13.9 percent in the Northeast moved to a different house.

Table 2. Percent Distribution by Mobility Status and Type of Mobility of the Civilian Papulatian — 1 Year Old and Over — by Regians in United States, April, 1955*

Region	Non-movers	Different House in the U. S.		
		Total	Same County	Different County
Northeast	85.6	13.9	9.6	4.3
North Central	80.7	18.8	13.0	5.8
South	77.8	21.6	14.6	7.0
West	69.3	29.6	18.3	11.3

Age and Migration

A comparison of the distribution of population in New Hampshire by age groups between 1940 and 1950 indicates a shift in the age composition despite the low net migration. The most noticeable shifts are increases in the proportion of children 0 to 9 years old and of people 55 years and over. There is a decided decrease in the proportion of people 10 to 24 years of age.

* Bureau of the Census, U. S. Department of Commerce Series, P. 20, No. 61, Table 6.

Table 3. Percent Distribution by Age Groups 1940 to 1950 in New Hampshire

Age Group	1940	1950
0– 4	7.3	10.2
5– 9	7.6	8.2
10–14	8.5	7.0
15–19	8.8	7.0
20–24	8.0	7.1
25–29	7.5	7.2
30–34	7.1	7.1
35–39	6.7	6.9
40–44	6.7	6.6
45–54	12.3	11.9
55 and over	19.5	20.6

A closer examination of the net migration by age group in Table 4 bears out these preliminary observations. There was a net movement into the state of children up to 14 years of age. There was a marked out-migration of those who would have been in the age group 20 to 34 by 1950 for both males and females. The exodus of males is greater than females during this period. The paradoxical situation of an increase in children and a decline in the age groups most likely to have children born in this period can best be explained by assuming that the out-migration of these age groups was mainly from unmarried persons. The couples with children who moved to the state in that period plus the increased birth rate probably accounted for the proportionately large number of children under 10 years of age. There was some decline in the 55 to 64 age groups but all others showed in-migration.

Table 4. Migration by Age Groups 1940 to 1950 in New Hampshire

1940 Age Group	1950 Age Group	Male	Female	Migration
Born after 1940	under 10	1138	1989	3127
0– 4	10–14	1052	961	2013
5– 9	15–19	—154	392	238
10–14	20–24	—2036	—1182	—3218
15–19	25–29	—2617	—1580	—4197
20–24	30–34	—905	—441	—1346
25–29	35–39	—78	524	446
30-34	40–44	293	609	902
35–39	45–49	273	233	506
40–44	50–54	395	444	839
45–49	55–59	—299	—172	—471
50–54	60–64	—119	—53	—172
55–59	65–69	489	472	961
60–64	70–74	427	327	754
65–74	75–84	231	434	665
75 and over	85 and over	218	467	685
		—1692	3424	1732

Migration by Age Groups for Each County

There are differences in net migration among the counties in New Hampshire as shown in Table 1. There are also marked differences among counties in the proportion of each age group which migrated. This is em-

Table 5. Net Percent Migration of 1940 Age Groups by Counties — 1940 to 1950

1940 Age Groups	State Total	Belknap	Carroll	Cheshire	Coos	Grafton	Hillsboro	Merrimack	Rockingham	Strafford	Sullivan
0– 4	5.6	10.2	1.5	9.7	—12.2	—5.8	4.6	3.4	25.2	12.5	7.3
5– 9	0.7	3.6	—17.9	—0.6	—22.3	—16.7	—1.5	—0.8	6.1	28.2	—14.5
10–14	—7.7	—18.9	—32.0	—10.3	—37.2	21.9[1]	—8.6	—14.4	—6.6	30.7[1]	—24.5
15–19	—9.7	—9.9	—19.3	—6.5	—31.5	—11.7	—8.9	—13.5	1.3	7.1	—16.1
20–24	—3.4	2.7	—6.8	—0.8	—20.2	—13.9	—2.8	—8.2	15.0	1.8	—6.9
25–29	1.2	6.3	—1.0	3.4	—15.5	—8.5	1.0	—2.8	17.9	6.6	1.3
30–34	2.6	7.3	1.1	6.7	—15.6	—6.9	3.9	2.2	16.3	5.1	—2.8
35–39	1.5	8.1	6.5	5.2	—15.3	—4.9	0.9	1.3	18.8	2.6	—3.4
40–44	2.5	1.8	4.6	2.6	—11.7	—1.5	1.8	3.7	16.3	5.4	—3.6
45–49	—1.4	6.3	2.2	0.9	—11.9	—6.4	—1.6	2.2	5.1	.9	—6.5
50–54	—0.6	—1.0	—2.1	—0.5	—11.6	—5.5	1.3	0.1	8.0	—1.9	—5.3
55–59	4.0	7.8	10.5	3.6	—2.4	2.3	5.3	—0.6	8.0	7.4	—3.2
60–64	3.3	3.0	6.7	2.1	—5.5	1.9	4.2	4.0	6.6	5.7	—1.9
All Ages	0.4	1.2	—2.3	2.0	—17.4	—2.0	—0.2	—1.0	12.2	9.8	—6.3

[1] Over estimates due to student population.

phasized in Table 5 where migration is expressed as a percentage of the 1940 age groups for each county. Coos, Grafton and Sullivan counties lost heavily in all age groups. With the exception of Rockingham and Strafford counties there was a net exodus from each county of the age groups who were 5 to 24 years of age in 1940 and who would have been 15 to 34 years in 1950. Industrial development and job opportunities undoubtedly contributed to a net increase in these productive age groups in the two southern counties of Rockingham and Strafford.

Rural — Urban Migration

The definition of rural farm and urban residence was different for the 1940 and 1950 census. Applying the 1940 definitions to the 1950 data made it possible, however, to establish the net migration of persons 0 to 54 in 1940 and who would have been 10 to 64 in 1950 by urban and rural residence classes. The results show a decrease in the rural farm and urban age groups and an increase in the rural nonfarm residents. For every 100 farm residents between the ages of 0 to 54 in 1940, for example, there were only 72 in 1950. For every 100 rural nonfarm residents between the ages 0 to 54 in 1940, there were 114 in 1950.

Table 6. Net Migration from 1940 to 1950 of Urban, Rural Farm and Rural Nonfarm Residents in the Age Groups 0 to 54 in 1940

	Net Migration	Percent of 1940 Population
Urban	— 8241	3.54
Rural Nonfarm	16830	14.38
Rural Farm	—13043	28.39

The increase in rural nonfarm residents can be explained by the movement of city residents to neighboring rural areas and small towns. Improved roads and transportation facilities together with improved incomes has accentuated this preference for small town life. The decline in farm residents is typical of the United States during and since the 1940-50 decade. The decrease in number of farms has been accompanied by an increase in the level of living of the remaining farm families. The number of farms in New Hampshire declined from 18,786 in 1945 to 10,411 in 1955 but the average size increased from 107 to 140 acres. The major sources of farm income are dairy and poultry. Cow numbers decreased somewhat during the decade from 65,000 to 59,000. At the same time, however, milk production per cow increased by at least 25 percent. Poultry numbers increased 20 percent from 1945 to 1955. The movement off farms does not indicate a decline in the economic significance of the industry so much as an economic reallocation of resources to increase the total product of the state. The farm-operator family level-of-living index as published by the USDA shows that the New Hampshire farm family level of living compares favorably with the rest of New England and is certainly higher than most other regions of the United States. There has been an improvement in levels of living as shown by a comparison of the 1930 level with 1950. Movement out of agriculture has in part contributed to this progress. There is some variation between counties and levels of farm-family living. The lowest levels are in Coos, Grafton, Belknap, and Carroll, and the highest are in Hillsboro, Cheshire, and Strafford.

Table 7. Comparison of Farm-Operator Family Level-of-Living Indexed for New Hampshire, New England, and the United States in 1930 and 1950[1]

Area	1930	1950	Increase
United States	75	122	47
New England	107	152	45
New Hampshire	105	151	46
Hillsboro	121	166	45
Cheshire	110	161	51
Strafford	113	160	47
Rockingham	110	158	48
Merrimack	103	147	44
Sullivan	96	146	50
Grafton	102	146	44
Belknap	103	144	41
Carroll	99	144	45
Coos	98	139	41

[1] Farm-Operator Family Level-of-Living Indexes for Counties of the United States. USDA. BAE. 1952.

Urban, Rural Nonfarm and Rural Farm Migration by Counties

The movement off farms or to nonfarm residences varied between counties. All counties lost urban residents, except Rockingham and Strafford, and all lost rural farm residents. The proportions are shown in Table 8.

Table 8. Estimated Migration by 1950 of Persons Who Were 0 to 54 in 1940 by Urban, Rural Nonfarm and Rural Farm Categories Expressed as Percentages of the 1940 Population for Counties of New Hampshire

County	Urban	Rural Nonfarm	Rural Farm
Belknap	—0.9	12.7	—24.9
Carroll	—	—3.1	—23.4
Cheshire	4.6	13.9	—42.7
Coos	—24.0	—10.5	—31.8
Grafton	—3.7	6.4[1]	—25.2
Hillsboro	—3.4	24.6	—33.9
Merrimack	—5.1	7.0	—23.0
Rockingham	7.2	31.9	—25.8
Strafford	0.4	56.7[1]	—7.9
Sullivan	—8.7	23.1	—32.9

[1] Inclusion of students inflates the percentage.

Effect of migration on Dependency Ratios

The dependency ratio is an expression of the relationship of the number of children 0 to 14 and the number of people over 65 to the number of persons in the age group 20 to 64. It estimates the number of dependents per 1,000 people aged 20 to 64. Comparison of this ratio between time periods indicates changes in the age structure of the population. It may indicate potential tax problems, shifts in the size and distribution of income, or possible changes in institutional requirements such as schools. Effects of migration on the population of an area or region are revealed in changes in the dependency ratio.

In a comparison between 1940 and 1950 the dependency ratio increased for all counties and all types of residents. For example, in Belknap County

the number of children 0 to 14 and persons 65 and over was 8,505 in 1940, while the number in the 20 to 65 age group was 13,682. Dividing the former by the latter and multiplying by 1,000 gives a dependency ratio of 622 in 1940. This means there were 622 dependents for each 1,000 persons in the working age groups. By 1950 the dependency ratio for Belknap County had increased to 678, indicating that there were 56 more dependents for each 1,000 of the working group.

The dependency ratios for 1940 and 1950 and the change between these dates is given in Table 9 for the state and for each county. Increases were greatest in rural nonfarm and rural farm groups.

Table 9. Dependency Ratios for 1940 and 1950 by Total, Rural Farm, Rural Nonfarm, and Urban Groups and the Change in Ratio between 1940 and 1950 for Counties and the State

County	Total			Rural Farm			Rural Nonfarm			Urban		
	1940	1950	Diff.	1940	1950	Diff.	1940	1950	Diff.	1940	1950	Diff.
Belknap	622	678	56	702	770	68	631	724	93	597	635	38
Carroll	642	722	80	688	732	44	630	720	90	—	—	—
Cheshire	597	674	77	631	735	104	609	727	118	565	599	34
Coos	644	684	40	747	859	112	658	732	74	608	607	—1
Grafton	600	647	47	659	740	81	588	716	128	587	664[1]	77
Hillsboro	526	591	65	619	710	91	616	702	86	504	562	58
Merrimack	581	653	72	678	761	83	647	720	73	527	608	81
Rockingham	589	682	93	649	737	88	627	708	81	534	639	105
Strafford	563	593	30	687	772	85	601	725	124	544	559	15
Sullivan	578	678	100	645	804	159	643	775	132	550	613	63
State	575	639	64	661	754	93	622	719	97	534	581	47

[1] The 1940 definition of urban applied to the male population decreased the influence of Dartmouth College.

Change in Dependency Ratio Due to Change in Dependents

An increase in the dependency ratio can occur because of the following: 1. An increase in children 0 to 14; 2. An increase in people 65 years and over; 3. A decrease in the working population 20 to 65 years of age; 4. Combinations of 1, 2, and 3.

In order to measure the relative importance of these categories in the general increases by state and by counties, resort was made to differential calculus.*

The increase in dependency ratios for each county of the state between 1940 and 1950 is given in Table 10. By comparing columns 2 and 3 it is possible to compare the relative importance of a change in the number of dependents with the relative importance of a change in the number in the working age groups. In Belknap county the increment due to a change in dependents was twice as great as that due to changes in the 20 to 64 age

* x = dependents y = number in age group 20-64 R = Dependency Ratio

$$R = f(xy) = \frac{x}{y}$$

$$\frac{\partial R}{\partial x} = \frac{1}{y} \qquad \frac{\partial R}{\partial y} = \frac{-x}{y^2}$$

$$\text{Change in R due to } \Delta x = \frac{1}{y}\,\Delta x$$

$$\text{Change in R due to } \Delta y = \frac{-x}{y^2}\,\Delta y$$

Table 10. Increase in Dependency Ratio 1940 to 1950 Due to Change in Dependents and Change in Working Population

County	Increase in Dependency Ratio	Increment Due to Change in Dependents	Increment Due to Change in 20 - 64 Age Group[1]
Belknap	56	108	—52
Carroll	80	73	7
Cheshire	77	124	—47
Coos	40	—16	56
Grafton	47	70	—23
Hillsboro	65	104	—39
Merrimack	72	74	—2
Rockingham	93	190	—97
Strafford	30	119	—89
Sullivan	100	100	—0
State	64	101	—37

[1] Negative sign = net increase in age group.

group. In Coos County the importance of a decline in the working age groups on the dependency ratio was over three times as great as the increase in dependents. In Sullivan County the increase in the dependency ratio was due entirely to an increase in dependents. For the state as a whole there were 64 more dependents per 1,000 of the working age groups between 1940 and 1950. The change in the dependents was three times as important as the change in the 20 to 64 age group. In other words the increased ratio was due to an absolute increase in the number of dependents between 1940 and 1950.

Increase in Dependency Ratio Due to Increase in Children or to Increase in Older People

As the dependency ratio includes both young children and older people as dependents, it is of interest to know which is the more important influence. Table 11 shows the increase in the ratio by counties between 1940 and 1950 and the relative importance of increases in the two age groups.

Table 11. Proportion of Increase in Dependency Ratio in New Hampshire Due to Increases in Persons 65 and Over and in Children 0 to 14 Years — 1940 to 1950

County	Percent Due to 65 Years and Over Group	Percent Due to 0 to 14 Years Group
Belknap	18	82
Carroll	42	58
Cheshire	22	78
Coos	90	10
Grafton	60	40
Hillsboro	31	69
Merrimack	46	54
Rockingham	6	94
Strafford	10	90
Sullivan	22	78
State	32	68

In Coos and Grafton counties the dependency ratio increase is due predominantly to an increase in older people. In the other counties increases in the number of young children accounts for the major part of the increase in dependents. In Rockingham, Strafford, and Sullivan counties this is particularly pronounced.

For the state as a whole 68 percent of the increase of 64 dependents per 1,000 working age group is due to an increase in children and 32 percent is due to an increase in older people. The increase in older people is due to the aging of the population. The difference between counties, however, is sufficient to show that any problems arising from increased dependents will require individual consideration for each county. Coos and Grafton and Merrimack counties have increased proportions of older people. Rockingham, Strafford, and Belknap have increased proportions of young children.

The Effect of Migration*

The changes in dependency ratios due to migration and changes due to natural causes are measured in Table 12. With the exception of the southern counties of Hillsboro, Rockingham, and Strafford, the migration accounted for the major part of the increased dependency ratios. Rockingham was affected more by the increased number of children under 14.

Table 12. Relative Significance of Changes in Dependency Ratios Due to Migration and Natural Causes for Counties of New Hampshire — 1940 to 1950

County	Increase in Dependency Ratio	Increment of Change Due to: Migration	Natural Causes
Belknap	56	35	21
Carroll	80	104	—24
Cheshire	77	43	34
Coos	40	119	—79
Grafton	47	10	37
Hillsboro	65	30	35
Merrimack	72	62	10
Rockingham	93	21	72
Strafford	30	0	30
Sullivan	100	62	38

[1] See Appendix III.

Migration, Birth Rate and Fertility Ratios

The fertility ratio measures the number of children 0 to 4 in relation to the number of women 15 to 44 in the population. Comparison of this ratio in 1940 with the ratio in 1950 will indicate changes in the population structure due to changes in the birth rate or migration. In 1940 there were in New Hampshire 337 children under 5 years of age per 1,000 women 15 to 44. By 1950 there were 488 such children per 1,000 women.

* See Appendix II

Table 13. Fertility Ratios for 1940 and 1950 and the Proportion of Increase Due to Changes in Number of Children 0 to 4 years and to Women 15 to 44 Years Old

County	Fertility Ratios 1940	1950	Increase in Fertility Ratio	Increment Due to Change in Number of Children 0 to 4	Increment Due to Change in Number of Women 15 to 44[1]
Belknap	319	494	175	195	—20
Carroll	381	512	131	117	14
Cheshire	346	494	148	184	—36
Coos	386	494	108	49	59
Grafton	364	498	134	124	10
Hillsboro	287	471	184	179	5
Merrimack	315	446	131	131	0
Rockingham	327	516	189	249	—60
Strafford	313	436	123	179	—56
Sullivan	335	515	180	169	11

[1] Negative sign = net increase in age group 15-44.

The birth rate increased between 1940 and 1950 with a noticeable bulge in births per 1,000 population in 1947, 1948, and 1949.

Table 14. Refined Birth Rate in New Hampshire — 1941 to 1950

Year	Population	Births	Rate per Thousand
1941	111,270	8,016	72.0
1942	111,520	8,797	78.9
1943	111,770	9,116	81.6
1944	112,020	8,229	73.5
1945	112,270	8,182	72.9
1946	112,521	10,779	95.8
1947	112,771	12,869	114.1
1948	113,021	12,123	107.3
1949	113,271	11,725	103.5
1950	113,522	11,324	99.8

The birth rate followed the same pattern as the marriages per 1,000 population with a year's lag. The marriage rate and the birth rate in 1950 were above what they were in 1940. The marital status of the New Hampshire population indicates a higher proportion married in 1950 than in 1940.

Table 15. Percentage of Population 14 Years and Over, Single, Married, and Widowed or Divorced

	Males		Females	
	1940	1950	1940	1950
Single	34.7	26.9	29.4	22.5
Married	58.0	65.7	56.9	62.6
Widowed/Divorced	7.1	7.4	13.7	14.9

The number of children 0 to 4 for every 1,000 women 15 to 44 was greater in 1950 than in 1940 for every county. The increased ratio was less in Belknap, Cheshire, Rockingham, and Strafford counties because of in-migration of females 15 to 44. The ratios in Carroll, Coos, Grafton, and Sullivan were higher because of a decrease in the proportion of women in

this age group. Hillsboro and Merrimack increases were due almost entirely to an increased number of children 0 to 4. The increased fertility ratio of Coos County is due in greater degree to a decline in women 15 to 44 than to an increase in children per 1,000 women of this age group.

Migration is the greatest influence on fertility ratios in Carroll and Coos counties. In the other counties natural causes were more significant.

Table 16. Related Significance of Migration and of Natural Causes on the Increased Fertility Ratios of New Hampshire Counties

County	Increase in Fertility Ratio	Increment Due to Migration	Increment Due to Natural Causes
Belknap	175	—2	177
Carroll	131	106	25
Cheshire	148	24	124
Coos	108	128	—20
Grafton	134	46	88
Hillsboro	184	42	142
Merrimack	131	48	83
Rockingham	189	30	159
Strafford	123	—12	135
Sullivan	180	74	106

Effect on Sex Ratio

The number of males per 1,000 females declined between 1940 and 1950 in all counties but Grafton.* With the exception of Carroll County, the greatest major influence causing this change in sex ratios was migration.

Table 17. Number of Males per 100 Females in Counties of New Hampshire and the Relative Significance of Migration and Natural Causes on these Changes — 1940 to 1950

County	Sex Ratio 1940	Sex Ratio 1950	Change	Increment Due to Migration	Increment Due to Natural Causes
Belknap	99.4	95.3	—4.1	—3.7	—.4
Carroll	102.0	99.9	—2.1	0	—2.1
Cheshire	103.2	98.1	—5.1	—3.9	—1.2
Coos	108.5	100.8	—7.7	—4.1	—3.6
Grafton	103.3	109.7	6.4	8.1	—1.7
Hillsboro	95.3	93.5	—1.8	—1.9	.1
Merrimack	97.6	92.9	—4.7	—4.0	—.7
Rockingham	99.0	96.3	—2.7	—1.8	—.9
Strafford	97.6	97.9	.3	.4	—.1
Sullivan	103.4	98.2	—5.2	—4.1	—1.1

* This is probably due to the inclusion of boarding students in the population.

Conclusions

The net migration from New Hampshire between 1940 and 1950 by numbers of persons was small. The major changes resulting from migration were in the age and sex structure of the population. This can in part be explained by the greater migration of some age groups than of others, and of males.

The greatest mobility between 1940 and 1950 occurred in the age groups 10 to 34. There was a net loss from the state of persons who were 10 to 24 in 1940 and who would have been 20 to 34 in 1950. A much smaller loss was apparent in the 45 to 64 age groups. All other age groups gained from migration and from births between 1940 and 1950. There was a net gain of females for the state.

Variation Between Counties

Examination of migration within New Hampshire reveals variation between counties and between age groups migrating. The 10 to 24 years group declined in all counties except Rockingham and Strafford. Coos and Grafton counties lost from almost all age groups. Migration was heaviest from the rural farm groups and for every 100 farm residents between the ages 0 to 54 in 1940 there were only 72 in 1950. This has coincided with a decline in the number of farms and farmers, but with an increase in the average size of farm, production per farm, and the total values of farm products sold. The level of living of farm families in New Hampshire has increased and compares favorably with the rest of New England as well as being higher than in most other sections of the United States.

There has been an increase in the number of residents who have moved to rural nonfarm areas to establish their homes. In some cases this is the result of industrial development in these areas. In other cases it is probably the result of individual preferences for homes in rural areas while commuting to jobs in industrial centers. Coos County lost urban, rural nonfarm, and rural residents.

Changes in Dependency Ratios

The dependency ratio, which is an expression of the number of dependents in relation to the working age groups, increased for the state. The greatest increases were in rural farm and rural nonfarm residents. This increase was in general due to an absolute increase in the number of dependents greater than the increase in the age groups 20 to 64. Dependents are composed of children 0 to 14 and persons 65 years and over. Both groups increased, but the greatest increase for the state was in the children 0 to 14 years of age. There was some variation between counties in this relationship. Coos and Grafton counties showed a greater relative increase in older people than in children. Migration was more significant than births and deaths in the changed dependency ratios for all but three southern counties.

Changes in Fertility Ratios

A further measure of changes in the structure of the population during the 1940 to 1950 period under study is provided by the fertility ratio which

measures the number of children 0 to 4 years of age relative to the number of women 15 to 44 years old. This increased for all counties and with the exception of Coos County was due to a greater number of children. In Coos County a decline in the number of women of child-bearing age from migration was greater than the increase in children.

Changes in Sex Ratios

There was a decline in the number of males relative to the number of females in all counties but Grafton. This exception is probably due to the inclusion of Dartmouth College students in the census count. In all counties but one the decline in sex ratio was due more to migration than to natural causes.

These are the major finding. They point to shifts in the age and sex structure of the population in the counties of New Hampshire as a result of migration. The methodology followed and the kind of observations which have resulted should provide useful guides to those interested and concerned with changes in the population and in the meaning of these changes to services, institutions, taxes, and markets.

Appendix I

Methodology

The general equation followed in estimating migration can be symbolized as follows: Initial population, plus births, minus deaths, plus or minus migration, equals final population.

Migration by Age Groups

In order to estimate migration by age group it was necessary to obtain initial and final population by specified age groups and to estimate the number of deaths occurring to this age group over the period of time in question. The problem was one of tabulating resident deaths by single years of age for each year of the period under study.

It was possible to obtain resident deaths by single years of age in New Hampshire from 1940 to 1950 from the State Department of Health, Division of Vital Statistics. The recorded deaths were mechanically sorted for each year according to the following criteria:

1. Place of Residence: N. H. residents who died in the state or out of state were included. Deaths of non-residents occurring in the state were excluded.
2. Age of Deceased: Excluding a few whose age was not stated.
3. County of Residence of the Deceased: Excluding a few whose residence was not stated.

Since the population is enumerated as of April 1, it was necessary to take the 1940 deaths from April 1 to December 31, and the 1950 deaths from January 1 to March 31, to coincide with the census taking.

It must be realized that the method of pairing deaths within an age group to population in that age group is not wholly accurate. An example will clarify this point. If an individual was aged 34 years, 11 months in April, 1940, he would be enumerated in the 30-34 age group. However, if he should die in June of the same year, his age at death would be 35. This would cancel out if we assume that a 29-year, 11-month individual may also die at the age of 30. In the higher age groups, however, with increasingly higher-age specific death rates, the cancellation may not be wholly complete.

It is also evident that deaths to residents between April, 1940, and April, 1950, will include deaths to in-migrants who are now residents, but who were not enumerated in 1940. This intrinsic factor would tend to slightly exaggerate net migration.

Since the population in 1940 of any age group is known from the U. S. Census, it is possible, by subtracting the deaths in the intervening period, to estimate the expected population in 1950. The difference between the expected population in 1950 and the actual census figure is an approximation of the net migration which has occurred over the period to the age group.

Migration by Residence Classification

Estimates of 1940 and 1950 state and county populations were immediately available from the respective censuses. However, two factors combine to limit the accuracy and completeness of the rural farm, rural nonfarm and urban data. They include: 1. The change in census definitions with respect to the rural-urban residence. 2. The estimation necessary to make the 1950 "old urban" definition of age classes coincide with the 1940 and 1950 regular age classes.

With respect to these factors it was necessary to use the supplementary figures in Table 50 of the 1950 census. Upon advice of the Population and Housing Division of the Bureau of the Census, the distribution by five-year age groups of the rural farm and rural nonfarm was based upon the distribution of the total rural population in Table 50.

In order to complete the estimates of migration by rural-urban residence. the cumulative deaths of the rural farm, rural nonfarm, and urban segments had to be estimated by assuming that deaths would be proportionate to the populations estimated above.

Appendix II

Assessing Relative Weight of Natural Causes and Migration

In the course of analyzing the mobility of the population of New Hampshire from 1949-1950, the need for assessing the relative weight of natural causes and migration arose. Many of the measures of population change are set up as ratios so that the dependent variable is a function of two or more independent variables. Under these conditions, it appeared that use might be made of partial derivatives in securing these weights.

To measure the amount of change in New Hampshire population, an expected population for 1950 had been computed based on the 1940 census and state vital statistics assuming no migration.

For any of the measures then 1950 minus 1940 is the actual change in the measure; 1950E minus 1940 is the change due to natural causes; and 1950 minus 1950E would represent the net change in the measure due to migration. This was not entirely satisfactory since it was impossible to tell which component of the measure was most important in inducing the change.

The changes were then analyzed in the following manner:

Expected 1950a — 1940a = a
Expected 1950b — 1940b = b
1950A — 1950 Expected A = A
1950B — 1950 Expected B = B

The change could now be written:

$$\Delta R = \frac{\Delta A}{\Delta B} = \text{Change due to migration}$$
$$\Delta r = \frac{\Delta a}{\Delta b} = \text{Change due to natural causes}$$
$$\Delta R + \Delta r = \text{Total change 1940-1950}$$

Using the partial derivatives, the equations were:

$$\Delta r = \frac{1}{b}\Delta a + \left(-\frac{a}{b^2}\right)\Delta b$$
$$\Delta R = \frac{1}{B}\Delta A + \left(-\frac{A}{B^2}\right)\Delta B$$

Since small populations (county) were the objects of analysis and since the sum of the partials is not likely to give true increments if the change is large compared to the base, it was felt desirable to minimize this limitation by taking the mean value of the two populations under consideration. Thus

$$a = \frac{\text{1940 pop.} + \text{1950 expected population}}{2}$$
$$A = \frac{\text{1950 expected pop.} + \text{1950 population}}{2}$$

The use of this device so ordered the values that in all cases the sum of all partials $1/b\Delta a + \left(-\frac{a}{b^2}\right)\Delta b + 1/B\Delta A + \left(-\frac{A}{B^2}\right)\Delta B$ is within .002 of the difference between the measure for 1940 and 1950.

In terms of the meaning $1/b\ \Delta a$ represents change in the numerator of the ratio due to natural causes; $-\frac{a}{b^2}\Delta b$ represents change in the denominator due to natural causes; $1/B\,\Delta A$ represents change in the numerator due to migration: and $-\frac{A}{B^2}\Delta B$ represents a similar change in the denominator.

If the measure used has more than one term in the numerator, the function can be written in the form $\frac{a+b}{c}$ and the equation will become $1/c\Delta a + 1/c\Delta b + \left(-\frac{a+b}{c^2}\right)\Delta c$ and equivalently for the change due to migration.

There follows an example worked out for the dependency ratio, including tabular computation form used and symbols.

a = mean population 0-14 1940 and expected 1950
b = mean population 65 and over 1940 and expected 1950
c = mean population 20-64 1940 and expected 1950
A = mean population 0-14 1950 expected and 1950 actual
B = mean population 65 and over 1950 expected and 1950 actual
C = mean population 20-64 1950 expected and 1950 actual

The formula followed:

$$\Delta r = 1/c\ \Delta a + 1/c\ \Delta b + \left(-\frac{a+b}{c^2}\right)\ \Delta c$$

$1/c\ \Delta a$ represents the amount of change in Δr attributable to change by natural causes in the age group 0-14.

$1/c\ \Delta b$ represents the amount of change in Δr attributable to change by natural causes in the age group 65 and over.

$-\frac{a+b}{c^2}\ \Delta c$ represents the amount of change in Δr attributable to change by natural causes in the age group 20-64.

$$\Delta R = 1/C\ \Delta A + 1/c\ \Delta B + \left(-\frac{A+B}{C^2}\right)\ \Delta C$$

$1/C\ \Delta A$ represents the amount of change in ΔR attributable to change by migration in the age group 0-14.

$1/C\ \Delta B$ represents the amount of change in ΔR attributable to change by migration in the age group 65 and over.

$-\frac{A+B}{C^2}\ \Delta C$ represents the amount of change in ΔR attributable to change by migration in the age group 20-64.

DEPENDENCY RATIO

County	$1/c$	$-\frac{a+b}{c^2}$	$1/c\Delta a$	$1/c\Delta b$	$-\frac{a+b}{c^2}\ \Delta c$	Δr
Belknap	.0000700	—.0000443	.0653100	.0102200	—.0541789	.0213511
Carroll	.0001110	—.0000699	.0101010	.0036630	—.0380955	—.0243315
Cheshire	.0000481	—.0000295	.0596440	.0204425	—.0463445	—.0337420
Coos	.0000429	—.0000257	—.0188331	.0319605	—.0939849	—.0808575
Grafton	.0000375	—.0000224	.0555750	.0287250	—.0464576	.0378424
Hillsboro	.0000111	—.00000564	.0662337	.0167721	—.0457235	.0372823
Merrimack	.0000276	—.0000161	.0163392	.0263304	—.0314916	.0111780
Rockingham	.0000290	—.0000182	.0865070	.0192850	—.0324888	.0115032
Strafford	.0000377	—.0000218	.0672191	.0102921	—.0470008	.0305104
Sullivan	.0000649	—.0000388	.0593186	.0318010	—.0535052	.0376144

County	$1/C$	$-\frac{A+B}{C^2}$	$1/C\Delta A$	$1/C\Delta B$	$-\frac{A+B}{C^2}\ \Delta C$	ΔR
Belknap	.0000673	—.0000444	.0155463	.0156136	.0042180	.0353779
Carroll	.0001120	—.0000746	.0300160	.0269920	.0472964	.1043044
Cheshire	.0000464	—.0000302	.0325728	.0097904	.0014194	.0437826
Coos	.0000445	—.0000274	—.0194910	—.0095230	.1482340	.1192200
Grafton	.0000369	—.0000236	—.0207378	.0051291	.0261960	.0105873
Hillsboro	.0000107	—.00000617	.0056175	.0134606	.01169215	.0307703
Merrimack	.0000275	—.0000171	.0234850	.0064350	.0312417	.0611617
Rockingham	.0000269	—.0000181	.0696441	.0171891	—.0652143	.0216189
Strafford	.0000349	—.0000207	.0258260	.0172755	—.0428697	.0002318
Sullivan	.0000649	—.0000419	.0149919	—.0110330	.0572773	.0612362

Appendix III

POPULATION CHANGE IN N. H. 1940 - 1950

Dependency Ratio

D.R. 1940	D.R. 1950	Diff.	Natural Change 0–14	65+	20–64	Sub Total	Migration Change 0–14	65+	20–64	Sub Total	Total Change
622	678	56	65	10	—54	21	16	16	4	36	57
642	722	80	10	4	—38	—24	30	27	47	104	80
596	674	78	60	20	—46	34	32	10	1	44	78
644	684	40	19	32	—94	—81	19	—10	148	119	38
600	647	47	56	29	—46	38	21	5	26	10	48
526	591	65	66	17	—46	37	6	13	12	31	68
581	653	72	16	26	—31	11	23	6	31	61	72
588	682	94	86	19	—34	71	70	17	—65	22	93
562	593	31	67	10	—47	30	26	17	—43	0	30
578	677	99	59	32	—54	38	15	—11	57	61	99

Labor Force Replacement

Male Exp. L.F.R.	Act. L.F.R.	Diff. Due Migration	Female Exp. L.F.R.	Act. L.F.R.	Diff. Due Migration
109	106	—3	109	111	2
106	97	—9	106	100	—6
107	104	—3	109	112	3
115	88	—27	119	96	—23
108	106	—2	108	101	—7
109	106	—3	110	109	—1
106	99	—7	105	102	—3
106	114	—8	106	118	12
108	118	—10	117	124	7
109	96	—13	110	104	—6

Fertility Ratio

F.R. 1940	F.R. 1950	Diff.	Natural Change 0–4	15–44	Sub Total	Migration Change 0–4	15–44	Sub Total	Total Change
319	494	175	194	—16	178	3	—5	—3	175
381	512	131	59	—35	24	52	54	106	130
346	494	148	154	—29	124	31	—6	24	148
387	494	107	21	—44	—23	23	105	128	105
364	498	134	114	—26	88	4	41	45	133
287	471	184	148	—1	147	30	7	37	184
316	446	130	90	—7	83	39	8	48	131
327	516	189	173	—14	158	84	—54	30	188
313	436	123	146	—11	135	42	—53	—12	123
335	515	180	126	—19	106	37	37	74	180

S.R. 1940	S.R. 1950	Diff.	Natural Change			Migration Change			Total Change
			Males	Females	Sub Total	Males	Females	Sub. Total	
99	95	—4	8	—8	—0	—1	—3	—4	—4
102	100	—2	4	—6	—2	—3	3	0	—2
103	98	—5	8	—9	—1	1	—4	—4	—5
108	101	—7	8	—11	—3	—20	16	—4	—7
103	110	7	10	—12	—2	—0	8	8	6
95	94	—1	8	—8	0	—1	—0	—2	—2
98	93	—5	5	—5	—0	—3	—0	—4	—4
99	96	—3	8	—9	—1	9	—11	—2	—3
98	98	0	8	—8	—0	8	—8	0	0
103	98	—5	9	—10	—1	—8	4	—4	—5